The “Where?” of Mixed Reality: Some Guidelines for Design

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Abstract
This paper presents some early design concepts for urban mixed reality (MR) environments. The concepts are based on preliminary analysis of an urban MR game. The objective is to explore how to create a unified user experiences through a combination of real and virtual elements.

Keywords
Mixed reality, place, presence, guidelines, games

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
Mixed reality (MR) environments combine real world and computer generated elements to create a multi-sensory user experience. Indeed as noted in a recent panel at the Presence 2007 Workshop, systems similar to TimeWarp (discussed later) force us to question issues such as place and presence [1]. Such questions include “Where am I?” and from the system designers perspective “Where do I want the users to be?”. Therefore as noted by Ciolfi and Bannon [2] it is necessary to explore the real elements of mixed reality as much as the virtual aspects.

This paper focuses on some early results from a study into a visor-based mixed reality game presented in the form of concepts which are specifically designed to explore the relationship between real and virtual elements of mixed reality games.

Presence and Place

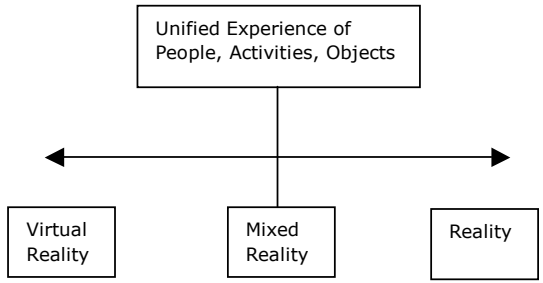

Figure 1: *The unified experiences of mixed reality are created by through balancing the relationship between real and virtual aspects of the space.*

Figure 1 is drawn from the work by Milgram [3], which is often referred to as the presence continuum. However rather than focusing on sense of presence its objective is to highlight where people feel present, for example more in the real or virtual experience. In contract a unified sense of presence occurs when people feel constantly within a new experience for the duration of the time they are intended to be there. For example the real and virtual elements combine in such experiences to make people feel as if they are genuinely in a new time period, or a new place. Rather than experience switches in sense of presence between real and virtual experiences – although it is acknowledged that being aware of changes may also be a desirable property. This definition has many commonalities with Gibson's concept of affordances [4], where he sees no difference between real or virtual. Instead affordances arise due to the user's perception of the features in the environment. It has been argued by some that through these affordances the user interacts in the environment and thus feels present. By exploring unified experiences and switches it also becomes important to consider aspects such as sense of place [5][6] which often consist of disparate related elements such as people, activities, and meanings as well as relationships between self, environment and others.

Timewarp

Figure 2: *A Heinzelmännchen in Cologne.*

TimeWarp is a mixed reality game which takes place in the City of Cologne. The objective is for the players to travel to different time periods and visit local characters known as Heinzelmännchen (Figure 2). The players

walk around within the real environment and the system augments the real location with virtual characters and objects as well as sound.

A number of study methods were used during the game, these included questionnaires based on MEC [7], the Social presence questionnaire [8] and the Place probe [9]. In addition the participants were observed and/or videotaped during the experience. They were also interviewed. Much of the system was developed prior to the evaluators being involved, hence the design can be through of as being separate from the evaluation phase.

Understanding the Real World

Based on our early results from the study we propose some concepts for the development of visor based MR systems. The proposed guidelines share many similarities with the work of Davidsson et, al [10], however they focus much more on the combination of real and virtual elements.

(1) Understand Attention Allocation Issues

Virtual objects should be carefully designed so as to ensure attention is allocated towards the most relevant part of the experience.

(2) Simplify the Interaction Scheme

Keep the number of interaction types to a minimum and introduce training scenarios which also form part of the game.

(3) User Safety

Avoid encouraging the user to focus on virtual elements when near potentially dangerous real aspects e.g. road crossings.

(4) Design appropriate paths through the environment

Utilise real elements such as paths to provide a rich narrative within the game.

(5) Understand the Locale

Spend time understanding and planning actions etc which are suitable within the locale.

(6) Interaction with Others

Try to include non-game participants in the experience, as well as other players.

(7) Seamful Design

Aspects of the environment may reduce GPS availability, where this is the case utilize faults as part of the game [11].

(8) Use a combination of real and virtual objects

Encourage interaction with real elements such as buying a drink or food.

(9) Provide a continuous experience

The emphasis should be on creating experiences which last for the duration of the game, and not

ones which constantly break due to lack of virtual elements or technical problems.

Conclusions

The guidelines presented here do not claim to be an exhaustive list but rather a starting point from which to consider the design of MR experiences. They are intended to highlight the importance of considering reality when building MR experiences, in particular how to make use of real spaces, people and objects in order to create a unified experience.

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